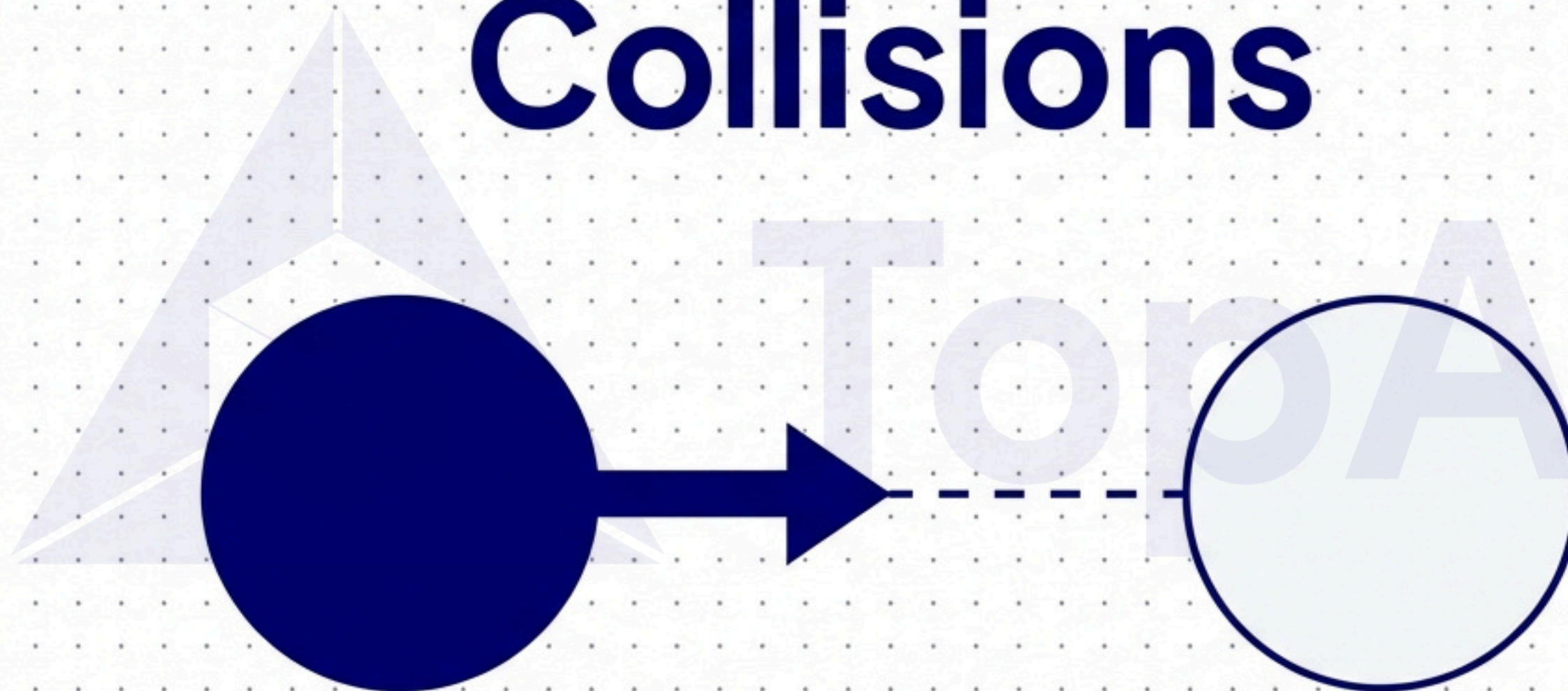
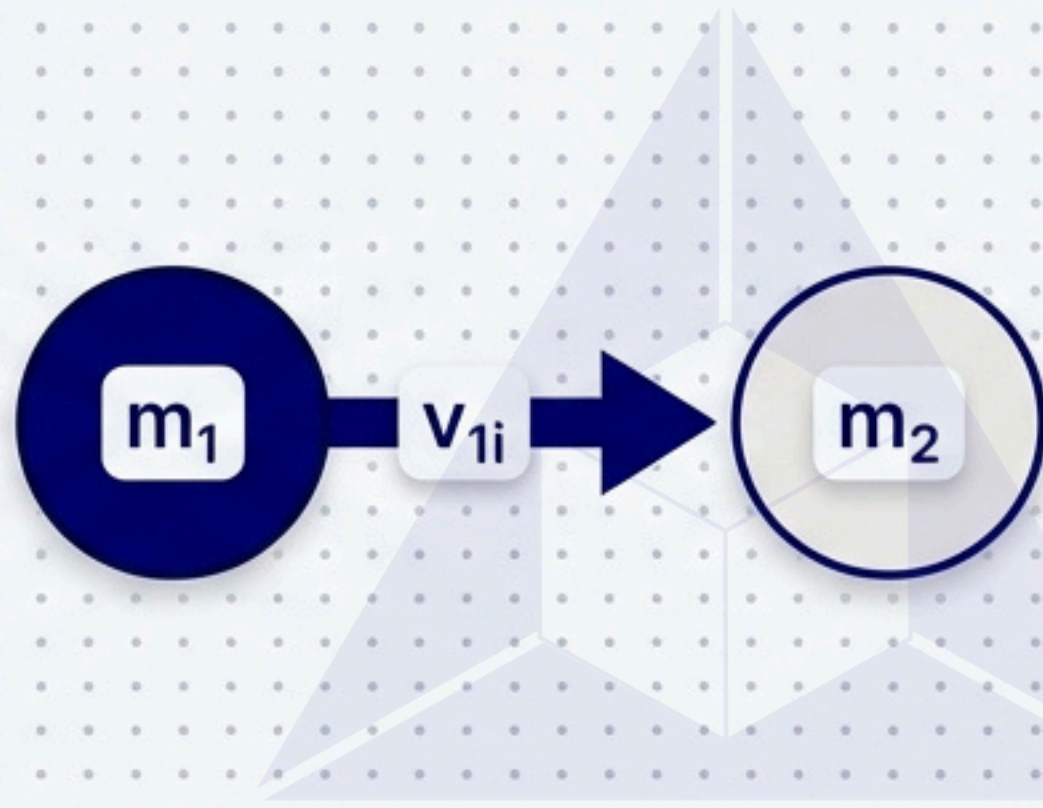


CHAPTER 5.11 | WORK, ENERGY & POWER

Collisions



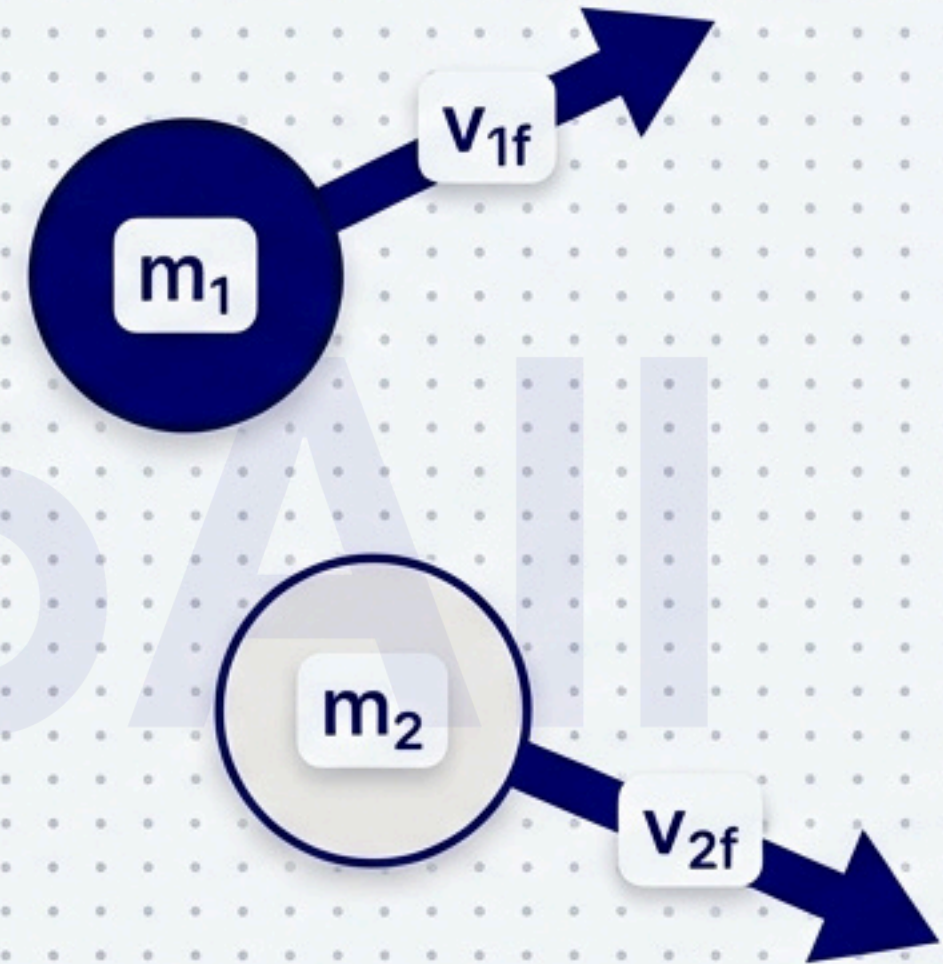
State A: Pre-Impact



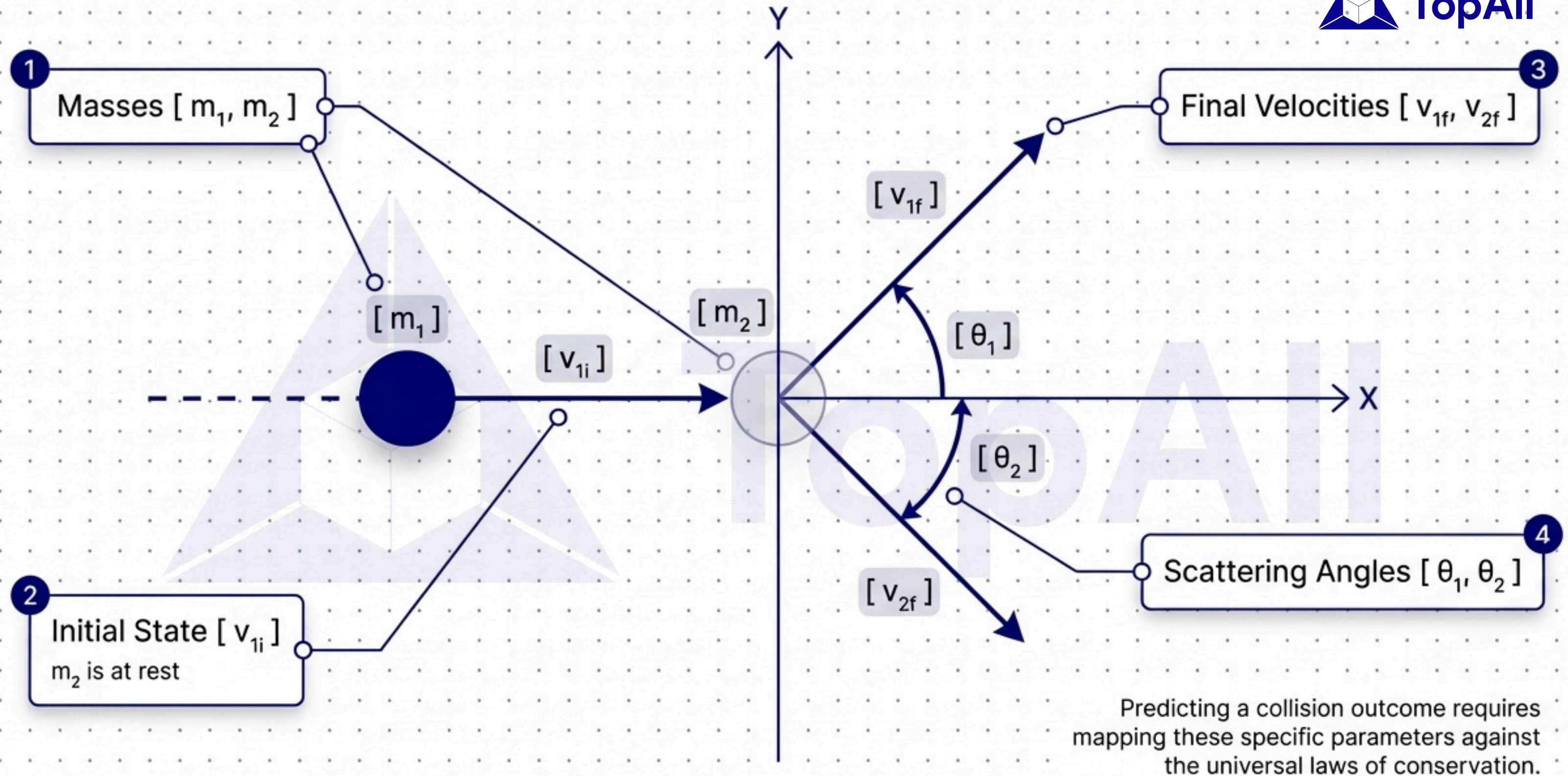
$$\mathbf{F}_{12} = -\mathbf{F}_{21}$$

$$\Delta t$$

State B: Post-Impact



Mutual impulsive forces cause an instantaneous change in momenta: $\Delta \mathbf{p}_1 + \Delta \mathbf{p}_2 = 0$.





**You've Learned the Theory.
Let's Test Them Now.**

$$E=mc^2$$



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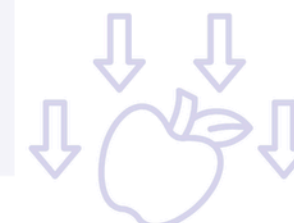
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Linear Momentum is ALWAYS conserved.

$$[p_i = p_f]$$

Collision Type	Momentum Conserved?	Kinetic Energy Conserved?	Final State
Elastic	✓ Yes	✓ Yes	Bodies separate
Inelastic	✓ Yes	✗ No (Lost to heat/sound/deformation)	Bodies separate
Completely Inelastic	✓ Yes	✗ No	Bodies stick together (v_f is common)

Key Takeaways

Takeaway 1 (Momentum):

Momentum is a universal constant across all collision types.

$$[m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}]$$

Takeaway 2 (Energy):

Kinetic Energy conservation is conditional. Only elastic collisions conserve it entirely; inelastic collisions dissipate it.

$$[K_i = K_f] \text{ (Elastic Only)}$$

Takeaway 3 (2D Collisions):

Vector geometry requires breaking momentum into independent X and Y axis components.

$$[X: m_1 v_{1i} = m_1 v_{1f} \cos\theta_1 + m_2 v_{2f} \cos\theta_2]$$

$$[Y: 0 = m_1 v_{1f} \sin\theta_1 - m_2 v_{2f} \sin\theta_2]$$

Valid when no external force acts on the system.



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